Management Plan for the Norris Tailwater Trout Fishery 2002-2006

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Management Plan for the Norris Tailwater Trout Fishery (2002-2006)

I. Goal

The Tennessee Wildlife Resources Agency (TWRA) seeks to enhance the quality of trout angling opportunities available to the variety of anglers who fish the Clinch River downstream of Norris Dam (the Norris tailwater).

II. Objectives

To meet the management goal for the Norris tailwater, TWRA will continue to provide put-and-take and put-grow-and-take fisheries for rainbow and brown trout capable of sustaining 40,000 trips/year during 2002-2006. Beginning in 2002, greater emphasis will be placed upon put-grow-and-take management to enhance existing trout populations and the quality of angling opportunities currently available. The primary objectives will be to increase the current abundance (as determined by annual monitoring) of trout ≥178 mm (7 inches) and ≥356 mm (14 inches) 25% by 2005. An additional objective will be to increase the abundance of trout ≥457 mm (18 inches) 25% by 2006.

III. Background

The Clinch River arises in southwestern Virginia and enters Tennessee in Hancock County. Norris Dam impounds the Clinch River 197 km (122 mi) downstream in Anderson County, forming 13,846-ha (34,213-acre) Norris Reservoir. Hypolimnetic discharges created coldwater habitat and rainbow trout were stocked in the tailwater shortly after completion of the dam in 1936 (Tarzwell 1939). The Tennessee Game and Fish Commission stocked trout during 1950-1970 and managed the river as a year-round fishery (Swink 1983). Because chronic low dissolved oxygen levels and a lack of minimum flow limited development of the trout fishery (Boles 1980; Yeager et al.1987), TVA began a Reservoir Release Improvements Program (TVA 1980) to address these problems. Dissolved oxygen concentrations were improved initially by fitting the turbines with a hub baffle

system (Yeager et al. 1987). Later (1995 and 1996), both turbines were replaced with a more efficient autoventing system (Scott et al. 1996), which maintains dissolved oxygen around 6 mg/L. A minimum flow of 5.7 m^3/s (200 CFS) was established in 1984 and has been maintained since then by a re-regulation weir located about 3.2 km (2 mi) downstream of the dam (Yeager et al. 1987). The weir was upgraded in 1995 to increase its holding capacity and improve public access (Bettoli and Bohm 1997).

Improvements in dissolved oxygen and minimum flows have increased the abundance and distribution of benthic invertebrates, as well as trout carrying capacity and trout condition (Yeager et al. 1987; Scott et al. 1996). The Norris tailwater currently supports a 22.5-km (14-mi) fishery for rainbow and brown trout before entering Melton Hill Reservoir. Put-and-take and put-grow-and-take management is accomplished by annually stocking both fingerling and adult trout. Bettoli and Bohm (1997) documented a small amount of natural reproduction by rainbow trout, but recruitment to the tailwater fishery was considered to be minimal. Some of this natural reproduction may come from Clear Creek, which large rainbow trout enter to spawn each winter. Clear Creek is closed to fishing from December 1 through March 31 to protect these fish. Banks and Bettoli (2000) attributed the lack of brown trout reproduction in the Norris tailwater to poor spawning substrate and unsuitable flows during spawning season. These factors probably limit successful rainbow trout reproduction as well.

As the trout fishery in the Norris tailwater has improved through better water quality and flow, it has gained increased popularity among trout anglers, especially those seeking large trout. The current state-record brown trout, weighing 13.04 kg (28.75 lb), was caught in the tailwater in 1988. In response to pressure from a stakeholder group in 1992, the Tennessee Wildlife Resources Commission established a 6.6- km (4.1-mi) “quality zone” between Cane Creek and the mouth of Llewellyn Island. Regulations in the quality zone prohibited the use of natural bait and included a 2-fish creel limit and a 356-mm (14-inch) minimum size limit (Bivens et al. 1995).

Another stakeholder group was dissatisfied with this change and the controversy led to a modification of the quality zone regulations in 1993. Later, the quality zone and its special regulations were eliminated; statewide trout angling regulations (7-fish creel limit, no bait or size restrictions) currently apply to the entire tailwater.

IV. Current Status

Aside from a few cursory surveys, trout population data for the Norris tailwater prior to 1995 is limited. TWRA sampled two stations in 1993 and 1994 (following establishment of the quality zone) using boat and backpack electrofishing gear during low flow (Bivens et al. 1994, 1995). The first intensive study of the Norris tailwater trout fishery was conducted between 1995 and 1997 (Bettoli and Bohm 1997). Results of that investigation indicated that the tailwater supported an overwinter standing crop of 112 kg/ha (99.8 lbs/acre) composed of about 80% rainbow trout and 20% brown trout. Among other Tennessee tailwaters, only the South Fork of the Holston River and Watauga River had higher trout biomass estimates at that time (Bettoli 1999). Bettoli and Bohm (1997) reported a relatively low return rate for stocked rainbow trout (19%) and very few brown trout were observed in the creel. The abundance of most cohorts of catchable (8-13 inch) rainbow trout stocked in the tailwater was found to be limited more by natural mortality than by angler harvest, thus the fishery is primarily supported by fingerling rainbow trout stocking (Bettoli and Bohm 1997; Bettinger and Bettoli 2000). High growth rates of stocked trout (about 20 mm or 0.8 inches/month for rainbows), allow the tailwater to produce quality-sized trout within a relatively short time (Bettoli and Bohm 1997).

TWRA's annual monitoring of Norris tailwater trout populations began in 1999 using the boat electrofishing stations (Figure 1) and protocol established by Bettoli and Bohm (1997). These monitoring stations are sampled at night in late February (with one unit at Norris Dam operating) to provide an assessment of the overwintering trout populations each year before stocking begins (Habera et al. 2000, 2001, 2002). Catch rates for trout ≥178 mm (7 inches), the minimum size

considered fully recruited to the sampling gear and technique, increased from 83.0 fish/h in 1996 to over 170 fish/h in 2001 and 2002 (Table 1). The average catch rate for this period was 129.5 fish/h (70% rainbow trout). Previously, an average of 69 fish/h (88% rainbow trout) was captured during night electrofishing samples at two stations in November 1994 (Bivens et al. 1995). Rainbow trout dominated the catch in the 1994 (88%) and 1996 (83%) samples, but brown trout were more abundant in 1999 (87%, Table 1). Subsequently, rainbow trout catch rates have increased (Table 1) and the relative abundance brown trout has dropped to about 15%.

Table 1. Electrofishing catch rates for Norris tailwater trout during 1996-2002.

Fish/h ≥7 inches			
Year	**Rainbow trout**	**Brown trout**	**Total**
1996[1]	68.5	14.5	83.0
1999	10.5	70.0	80.5
2000	81.2	56.7	137.9
2001	148.4	27.2	175.6
2002	146.3	24.1	170.4
Mean	91.0	38.5	129.5

[1]Data are from Bettoli and Bohm (1997) and represent the same 12 stations sampled during 1999-2002.

Catch rates for larger trout collected during the 1996-2002 monitoring efforts are provided in Table 2. Even though total brown trout catch rates and relative abundances have decreased since 1999 (Table 1), catch rates for trout ≥14 inches have generally increased during that period (Table 2). This is partially related to the increase in catch rates for rainbow trout ≥14 inches, but may reflect an increase in the average size of brown trout as well. The average catch rate since 1996 is 18.0 fish/hr (55% rainbows). Brown trout represent most of the Norris tailwater fish ≥18 inches (Table 2) and catch rates for this size group have declined since 2000 (as brown trout abundance in general has declined). The 1994 samples (Bivens et al. 1995) produced total catch rates for trout ≥14 inches and ≥18 inches of 21.3 fish/hr and 3.0 fish/hr, respectively.

Table 2. Electrofishing catch rates for larger trout from the Norris tailwater (1996-2002).

Year	Rainbow trout	Brown trout	Total
Fish/h ≥14 inches			
1996[1]	6.5	3.0	9.5
1999	2.0	6.9	8.9
2000	7.4	17.8	25.2
2001	12.9	7.4	20.3
2002	20.9	5.4	26.3
Mean	9.9	8.1	18.0
Fish/h ≥18 inches			
1996[1]	0.0	0.5	0.5
1999	0.0	1.0	1.0
2000	0.5	7.4	7.9
2001	2.5	4.5	7.0
2002	1.0	3.4	4.4
Mean	0.8	3.4	4.2

[1]Data are from Bettoli and Bohm (1997) and represent the same 12 stations sampled during 1999-2002.

Composite length frequency distributions for all trout ≥7 inches collected during the 1996-2002 monitoring surveys are provided in Figure 2. Rainbow trout up to 23 inches have been collected, although 74% of the catch was in the 8-12 inch size range. Brown trout up to 28 inches have been captured, with fish in the 9-13 inch size classes being most abundant (71%). Trout ≥14 inches represented about 14% of all fish captured during 1996-2002, while about 3% were ≥18 inches (Figure 2).

Rainbow and brown trout stocking rates for the Norris tailwater since 1990 are provided in Table 3. About a quarter of a million (251,000) 4-13 inch trout were released annually during 1990-2001.

Table 3. Stocking rates for the Norris tailwater during 1990-2001.

Year	Rainbow Trout	Brown Trout	Total
1990	303,294	26,024	329,318
1991	230,656	17,932	248,588
1992	203,687	20,005	223,692
1993	264,728	--	264,728
1994	187,935	10,004	197,939
1995	197,756	17,539	215,295
1996	122,208	13,937	136,145
1997	217,367	125,501	342,868
1998	198,894	111,362	310,256
1999	199,042	20,000	219,042
2000	242,257	10,453	252,710
2001	193,349	77,964	271,313
Mean	213,431	40,975	250,991

Fingerlings (4-6 inch fish) made up 80-85% of the rainbow trout stocked each year except in 1996 (74%). About 176,000 fingerling rainbows were released in the Norris tailwater annually during 1990-2001, yielding a stocking density of 701/ha (284/acre). The rest of the rainbow trout stocked in the Norris tailwater (about 37,000/year) were catchables. Survival of these catchable rainbow trout is poor and few contribute to the fishery. Most die (possibly from energetic costs of excessive movement) or emigrate into Melton Hill Reservoir (Bettoli and Bohm 1997; Bettinger and Bettoli 2000). Bettoli (2000) considered the potential for striped bass *Morone saxatilis* predation on stocked trout to be inconsequential because the striped bass population (in Melton Hill Reservoir) is small and few ever move upstream of the shoals near the Highway 61 bridge. Despite the importance of rainbow trout fingerlings to the Norris tailwater's trout fishery, there are no data to indicate what stocking density is ideal. Therefore, the current rate may not be maximizing the tailwater's potential.

Most brown trout stocked in the tailwater during 1990-2001 have been 7-9 inch fish, although all of the browns stocked in 1990 and 1996 and 74% of those stocked in 2001 were 4-6 inch fish. The brown trout stocking rate was increased substantially in 1997 and 1998 (Table 3) and included about 100,000 4-inch fingerlings each year. Recruitment from these stockings most likely led to the high brown trout catch rate and relative abundance in 1999 (Table 1), as well as the increases in catch rates for larger trout in 2000 (Table 2). With the return to more regular brown trout stocking rates during 1999-2000 (~15,000/year), brown trout catch rates declined and rainbow trout again dominated the fishery. These results indicate that higher brown (or rainbow) trout stocking rates could help achieve management objectives that seek to increase overall trout abundance and the abundance of larger fish in the Norris tailwater.

Creel data from several surveys on the Norris tailwater (Table 4) indicate that angling pressure estimates appear to have stabilized recently and harvest has decreased somewhat. Current fishing pressure on the Norris tailwater is intermediate among other Tennessee tailwaters and is exceeded by pressure on the Watauga, Caney Fork, and South Fork Holston rivers (Bettoli 2002). The developing trout fishery in the nearby Cherokee tailwater (Holston River) is becoming increasingly popular and is probably now drawing a certain amount of angling pressure away from the Norris tailwater.

Catch rates for the Norris tailwater have generally declined since 1995, although catch rates over 0.7 fish/h are generally considered representative of good fishing (McMichael and Kaya 1991; Wiley et al. 1993). Anglers made an estimated 24,392 trips to the Norris tailwater during March-October 2001 (Bettoli 2002), which is statistically similar to pressure for a comparable interval in 1996-1997. However, average trout catch per hour and per trip in 2001 were significantly lower relative to the previous survey (Bettoli 2002). The proportion of completed trips in 1996 for which no trout were harvested (63%, Bettoli and Bohm 1997) increased to 79% in 2001

(Bettoli 2002). Over 80% of Norris tailwater anglers are residents of Knox, Anderson, and Campbell counties and over 70% fish with bait (Bettoli and Bohm 1997; Bettoli 2002).

Table 4. Creel survey results for the Norris tailwater.

Survey	Estimated pressure (h)	Estimated harvest (trout)	Catch rate (trout/h)
TVA (1973-1988 average)	66,023	29,899	0.43
Fraser (1995)	--	--	1.20
Bettoli and Bohm (1997)[1]	89,388	30,456	1.01
Bettoli (2002)[2]	87,081	25,739	0.62

[1]Data for April-October 1996 and March 1997.
[2]March-October 2001.

V. Management Actions

The following actions are recommended for 2002-2006 to achieve the Norris tailwater management objectives and ultimately fulfill the management goal for this extremely valuable trout fishery. All of these activities are currently underway.

1. Stock 36,000 catchable (9-13 inch) rainbow trout each year.

2. Stock 20,000 8-inch brown trout each spring, plus an additional 100,000 (minimum) brown trout fingerlings annually through 2005. Continue supplemental stocking annually after 2005 if objectives are met.

3. Stock 160,000 4-inch rainbow trout each spring, plus an additional 100,000 (minimum) rainbow trout fingerlings annually through 2005. Continue supplemental stocking annually after 2005 if objectives are met.

4. Evaluate the trout fishery annually by electrofishing the 12 established monitoring stations in late February to determine abundances and size structures. The primary objectives for enhancing

the Norris tailwater (Table 5) are to increase monitoring catch rates for trout ≥7 inches and ≥14 inches by 25% relative to the 2000-2002 average by 2005.

Table 5. Objectives for enhancing the Norris tailwater trout fishery (2002-2006).

Electrofishing catch rates (fish/h)	2000-02 average	Objective	
		By 2005	By 2006
≥7 inches	161	200	200
≥14 inches	24	30	30
≥18 inches	6.4	--	8

The 2000-2002 monitoring samples will be used for comparisons as they produced the three highest catch rates to date. An additional objective for 2006 is to increase monitoring catch rates for trout by 25% relative to the 2000-2002 average. If the catch rate objectives (excluding ≥18 inch fish) can be met by 2005, then the primary objectives of this management plan will have been achieved. The objective for trout ≥18 inches may be more difficult to attain and failure to reach it alone would not be indicative of failure of the overall management strategy.

5. Genetically identify the large rainbow trout that attempt to spawn in Clear Creek each winter if possible and emphasize this strain in the stocking program (particularly fingerlings).

6. Enforce angling regulations as prioritized in the quarterly law enforcement planning process.

7. Increase angler access to the river if possible.

8. Continue to work with the Norris tailwater biomonitoring team.

9. Obtain input from anglers to determine their level of satisfaction with the quality and variety of trout angling opportunities being provided in the Norris tailwater (e.g., through the annual

telephone surveys being conducted by the University of Tennessee Department of Forestry, Wildlife, and Fisheries).

10. Evaluate the feasibility of introducing brook trout into the Norris tailwater trout fishery.

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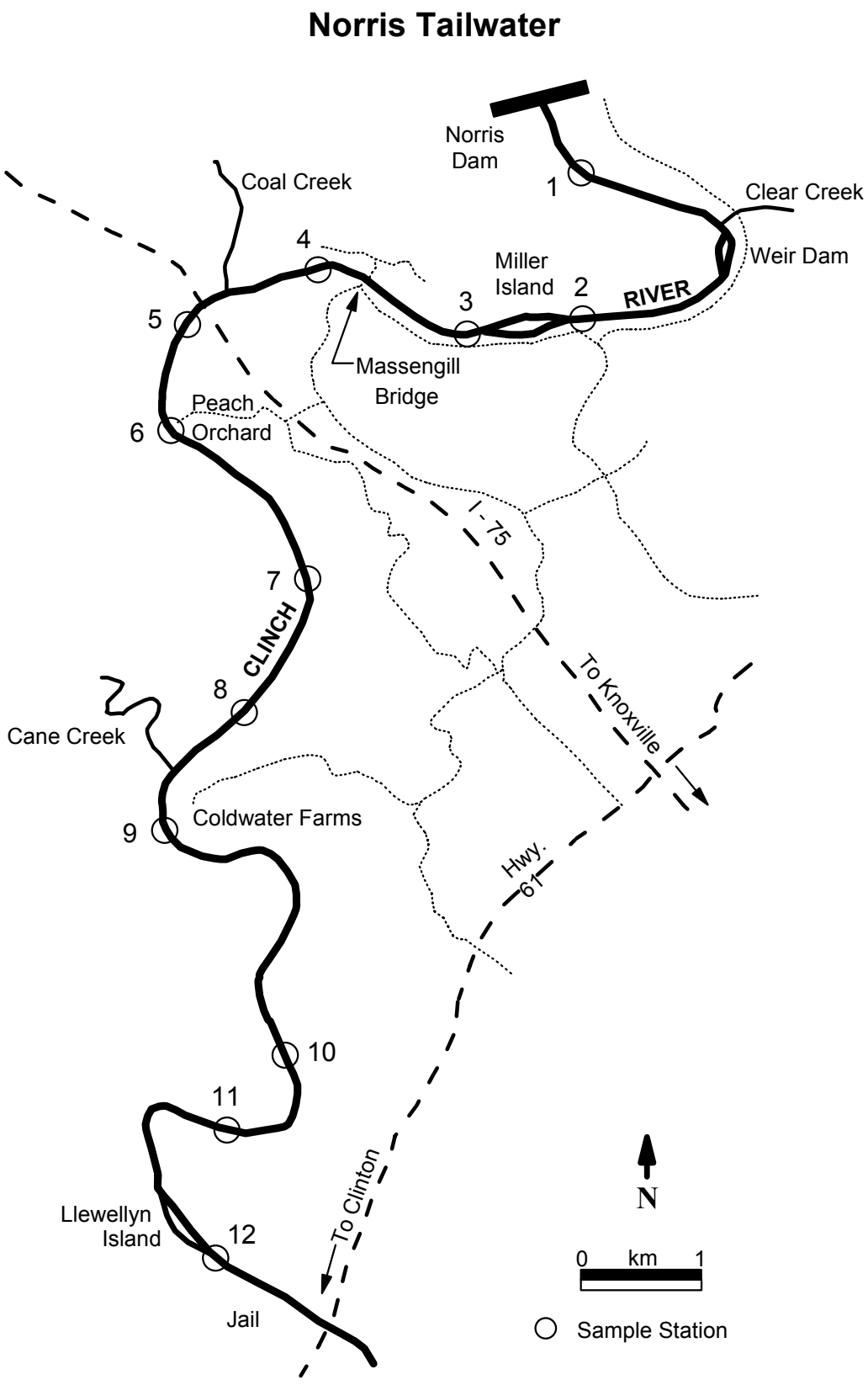

Figure 1. Locations of the 12 monitoring stations on the Norris Tailwater.

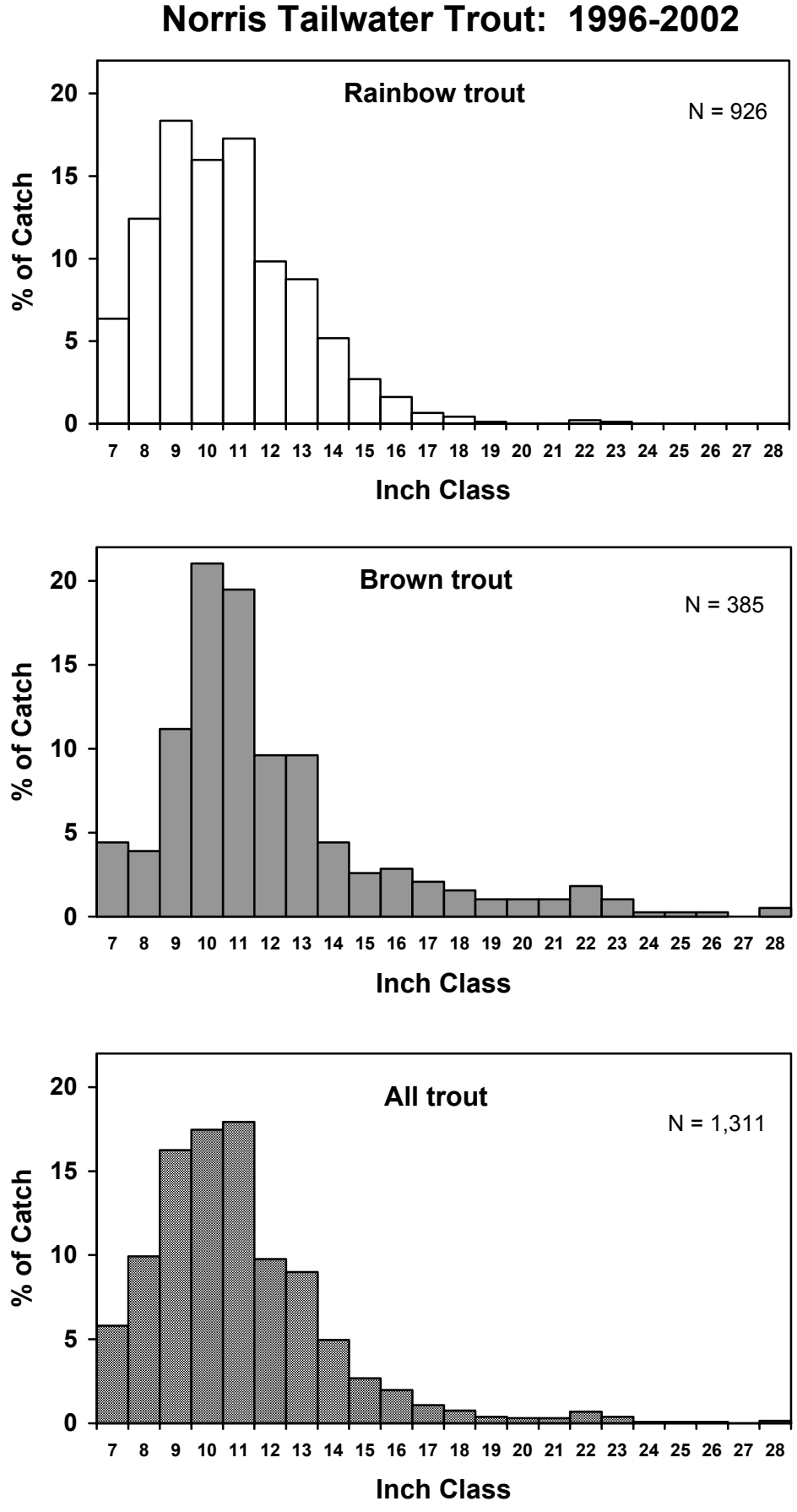

Figure 2. Composite length frequency distributions for trout from the 12 monitoring stations on the Norris tailwater sampled during 1996-2002.